

Investing in Women's Agricultural and Mining Enterprises in Climate-Affected Communities of Northern Ghana and Nigeria



Recommendations for Renewable Energy Solutions | 2025



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List of Acronyms

Acronym	Full Meaning
AfDB	African Development Bank
AFAWA	Affirmative Finance Action for Women in Africa
AMV	African Mining Vision
APYIN	Association of Positive Youths in Nigeria
ASM	Artisanal and Small-Scale Mining
AU	African Union
BOI	Bank of Industry
CGE Africa	Center for Gender Economics in Africa
DBG	Development Bank Ghana
dRPC	Development Research and Projects Centre
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
FAO	Food and Agriculture Organization
FARA	Forum for Agricultural Research in Africa
IEA	International Energy Agency
IFPRI	International Food Policy Research Institute
IREEWAM	Increasing Renewable Energy Investments for Empowerment of Women in Sustainable Agriculture and Lithium Mining in West Africa
KII	Key Informant Interview
MDAs	Ministries, Departments, and Agencies
NAIIS	Nigeria AIDS Indicator and Impact Survey
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
NHRC	National Human Rights Commission
NORPRA	Northern Patriots in Research and Advocacy
NPC	National Population Commission (Nigeria)
PPP	Public-Private Partnership
PUE	Productive Use of Energy
RE	Renewable Energy
REEEP	Renewable Energy and Energy Efficiency Policy
SACA	State Agency for the Control of AIDS
SASCP	State AIDS and STI Control Programme
SDG	Sustainable Development Goal
SEforALL	Sustainable Energy for All
SME	Small and Medium Enterprise
UN	United Nations
UNDP	United Nations Development Programme
VGGT	Voluntary Guidelines on Responsible Governance of Tenure
WB/WBG	World Bank / World Bank Group

About the Project

Project Title: Increasing Renewable Energy Investments for Empowerment of Women in Sustainable Agriculture and Lithium Mining in West Africa (IREEWAM, West Africa)

This report presents the needs assessment conducted under the IREEWAM Project, which seeks to address structural gender inequalities in two critical and fast-evolving sectors of West Africa—sustainable agriculture and lithium mining. The project is premised on the understanding that women, despite being central to agricultural production and active participants in artisanal and small-scale mining, remain concentrated in lower-value roles with limited access to skills, technology, and decision-making power. Simultaneously, renewable energy offers a transformative pathway to strengthen women’s resilience, productivity, and leadership in these climate-sensitive sectors.

The project pursues four interlinked objectives. First, it seeks to identify and address gender disparities by equipping women with the technical skills, financial tools, and opportunities needed to move into higher-value roles within agriculture and lithium mining. Second, it promotes gender-inclusive policies, frameworks, and financing models that will support women’s effective participation and leadership in renewable energy, **ensuring that energy transitions are not only green but also equitable**. Third, the project is building strong partnerships between public and private stakeholders to create an enabling environment for women to thrive in these industries. Finally, the initiative aims to raise public awareness and improve media reporting on women’s contributions and challenges across agriculture, mining, and energy, thereby reshaping narratives and influencing long-term cultural and policy shifts.

IREEWAM is implemented through a consortium of committed partners: the Center for Gender Economics in Africa (CGE Africa), Ziva Community Initiative, and the Northern Patriots in Research and Advocacy (NORPRA). Together, these organizations bring expertise in gender-responsive research, advocacy, and community mobilization, ensuring that interventions are grounded in evidence and responsive to local contexts.

The first phase of the project will run from January 2025 to December 2025, beginning with **this needs assessment** to provide a strong evidence base for action. **The assessment** identifies the key socio-economic, energy, climate, and institutional challenges faced by women in agriculture and lithium mining, while also pointing to opportunities for renewable energy solutions that can advance gender equality and sustainable development in West Africa.

Executive Summary

This needs assessment examines the link between gender, climate change, agriculture, artisanal and small-scale mining (ASM), and renewable energy in selected communities in Northern Ghana and Northern Nigeria. Data were gathered through surveys, consultative forums, key informant interviews (KIIs), and desk reviews. In Nigeria, the study focused on Kwara State and Nasarawa State, which represent two distinct agro-ecological and socio-economic regions in the northern part of the country.

The findings show that women involved in both agriculture and mining face increased vulnerabilities due to climate change, such as irregular rainfall, lower crop yields, higher energy costs, and unsafe working conditions in the mining sector. Access to energy for productive purposes remains limited, with most women relying on costly and inefficient sources. Renewable energy solutions, particularly solar-powered irrigation systems, solar dryers, and clean mining technologies, are crucial for enhancing livelihoods, reducing gender disparities, and improving climate resilience.

Key recommendations include developing gender-responsive policies that integrate renewable energy into agricultural and mining value chains, broadening financing options for women-led businesses, and strengthening cross-border learning platforms between Ghana and Nigeria.

Acknowledgments

We want to thank the women farmers and artisanal miners in the targeted communities of Northern Ghana and Northern Nigeria for their time, insights, and openness during the assessment process. In Nigeria, special thanks go to the respondents in Kwara State and Nasarawa State, whose contributions provided a detailed understanding of regional challenges and opportunities. We also appreciate the local government representatives, civil society organizations, and renewable energy providers in Ghana and Nigeria who shared valuable perspectives. This assessment was made possible through the collaboration of partners across both countries, whose dedication to gender equality, climate resilience, and sustainable energy access continues to inspire our work.

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1. Introduction

1.1 Introduction

Climate change continues to pose a significant threat to food security, economic stability, and community well-being across sub-Saharan Africa. In rural and peri-urban areas, women lead in agriculture and small-scale mining. However, they often face limited access to resources, technology, and decision-making platforms. Energy poverty further hampers their ability to adapt to climate impacts and grow their economic opportunities.

Women farmers and miners face multiple, overlapping disadvantages. In agriculture, the lack of irrigation, cold storage, and mechanized processing often leads to post-harvest losses of up to 40%. In ASM, women are typically limited to lower-value activities, such as crushing and washing ores, which are labor-intensive, hazardous, and energy-demanding. Without access to affordable and reliable energy, women are unable to fully participate in higher-value segments of the value chain.

Although the blue economy is more prominent in coastal and riverine settings, the principles of sustainable resource management, renewable energy integration, and gender inclusion remain relevant inland. A green transition in agriculture and mining anchored in renewable energy can simultaneously reduce greenhouse gas emissions, improve productivity, and enhance women's resilience to climate shocks.

1.2 Objectives of the Assessment

The primary goal was to assess the energy needs, constraints, and opportunities for women in agriculture and artisanal mining in selected climate-affected communities of Northern Ghana and Northern Nigeria. The study aimed to determine how renewable energy technologies could address these gaps and promote inclusive, climate-resilient livelihoods.

Objectives

1. To examine the socio-economic profiles of women engaged in agriculture and mining in the study areas.
2. To assess women's current sources and uses of energy, and identify gaps in access, affordability, and reliability.
3. To analyze the impacts of climate change on women's livelihoods and document their existing adaptation strategies.
4. To identify renewable energy solutions that are feasible, acceptable, and scalable within the study contexts.
5. To evaluate the policies, programs, and institutions that support or constrain women's participation in renewable energy-driven value chains.

1.3 Key Research Questions

1. What are the socio-economic profiles of women involved in agriculture and mining in the study areas?
2. What are their current sources and uses of energy, and what gaps remain in access, affordability, and reliability?
3. How does climate change impact their livelihoods, and what adaptation strategies are they using?
4. What renewable energy solutions are feasible, acceptable, and scalable in these contexts?
5. What policies, programs, and institutions currently support or hinder women's participation in renewable energy-driven value chains?

The findings support the achievement of multiple Sustainable Development Goals (SDGs), including SDG 5 (Gender Equality), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), and SDG 13 (Climate Action). They also align with ECOWAS policies on gender mainstreaming in energy access and the African Union's Agenda 2063 goals for inclusive, sustainable development.

While each country has unique socio-economic and environmental dynamics, the study aimed to identify similarities and opportunities for cross-border collaboration in renewable energy programs.

1.4 Research Methodology

Approach

A mixed-methods, participatory, gender-responsive approach was employed. Quantitative data were collected through structured surveys administered to women involved in agricultural and mining businesses. Qualitative insights were obtained from Consultative Forums and KIIs with women leaders, local government officials, energy providers, and civil society actors. Desk reviews of relevant policy documents and reports complemented the primary data.

Data Collection Tools

- **Literature Review:** Analyzed national policies, regional frameworks, and previous project evaluations.
- **Surveys:** Collected demographic data, energy usage patterns, livelihood constraints, and aspirations.
- **Consultative Forums:** Explored community-level perceptions, challenges, and collective opportunities.
- **KIIs:** Gathered expert perspectives on institutional and policy contexts.

Sampling Strategy

Purposive sampling ensured representation of women in both agriculture and mining sectors. In

Nigeria, data was collected from Kwara State, known for its agrarian economy with pockets of artisanal mining, and Nasarawa State, where mining is more prominent alongside subsistence and smallholder agriculture. In Ghana, sampling was conducted in selected districts of the Northern Region, where similar economic activities are prevalent.

Ethical Considerations

Informed consent was obtained from all participants. Data was anonymized to protect privacy. Cultural norms were respected during engagement, with female facilitators conducting KIIs and Consultative Forums in communities where this was more culturally appropriate.

2. Literature Review

2.1 Overview

In this segment, I will evaluate recent scholarship (2021-2025) concerning the nexus of gender, climate change, agriculture, artisanal and small-scale mining (ASM), and renewable energy in sub-Saharan Africa, with particular reference to Northern Ghana and Northern Nigeria. I will incorporate findings from academic literature, institutional reports, and policy documents from the World Bank, UN Women, ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), the Food and Agriculture Organization (FAO), and other relevant organizations. This analysis will provide the empirical and policy context for rationalizing investments in women's agriculture and mining enterprises with renewable energy.

2.2 Gender and Climate Vulnerability in Northern Ghana and Nigeria

Over recent years, climate change has become a major factor causing uneven rainfall, floods, and droughts across West Africa, which especially harms women smallholders and micro-entrepreneurs (Food and Agriculture Organization [FAO], 2024). Recurrent floods in Nigeria's Niger and Adamawa States have destroyed croplands and rural assets, increasing vulnerabilities for female-headed households (World Bank, 2023). In Ghana, fluctuations in rainfall and heat stress worsen the production of shea, rice, and maize, which are women-managed crops and are vitally important (Arthur, Dzanku, & Quaye, 2022).

Women from both countries have limited land rights, access to credit, climate information, and extension services, and these gendered constraints reduce their adaptive capacity (Olawuyi, Ahmed, & Obayelu, 2023). Studies conducted in Kwara and Nasarawa States show that irregular rainfall and energy scarcity caused by climate change are decreasing the productivity and income women earn from crop and processing businesses (Adeoti & Ojo, 2024). These multiple barriers make the need for women to access affordable renewable energy even more critical.

2.3 Women in Artisanal and Small-Scale Mining (ASM)

In Ghana and Nigeria, artisanal and small-scale mining earns income for more than one million women (Hilson & McQuilken, 2023). However, women are relegated to the most difficult and lowest-paid tasks—ore hauling, crushing, and washing—while men handle the more lucrative and less dangerous roles of extraction and trade (Ofosu-Mensah, 2022).

The threats to people's health and the environment are far-reaching. In the construction of the Stand Still Ghana project (UNEP, 2024) and the National Committee on Mercury-Free Gold Mining in Nigeria (Federal Ministry of Environment, 2025) undertaken reports, the use of mercury in gold processing is flagged as exposing women and children to deadly attachments. Mercury-free, solar-powered concentrators are adopted, yet high upfront costs and access to finance negatively impact safety and increase risks. The use of technology, granting women's ASM cooperatives, and access to safe and productive mining livelihood is a leading way to the profitable (Hilson, 2024) safe mining livelihood.

2.4 Renewable Energy for Productive Use (PUE) in Agriculture and Mining

2.4.1 Solar Irrigation and Mechanization

Women farmers have experienced remarkable productivity increase and resilience due to the use of solar-powered irrigation and mechanization. Case studies in northern Nigeria and Ghana's Upper East Region indicate 40-60% yield growth and less drudgery compared to diesel-powered irrigation systems (International Livestock Support and Sustainable Intensification [ILSSI], 2023; SEforALL, 2024). In addition to these benefits, solar irrigation systems allow for the cultivation of crops out of the traditional growing season and free women's time for other income-earning work. In spite of these benefits, high costs for system purchase and maintenance are still problematic to most farmers (Borlaug Institute for Agriculture, 2023).

2.4.2 Solar Dryers and Cold Chains

According to Nigeria's Integrated Energy Plan, solar-powered dryers, mills, and cold rooms have the potential to reduce post-harvest losses by 25-30%. Similarly, the Ghana Compact 2025 highlights the importance of solar irrigation and storage systems for agricultural competitiveness. When women's cooperatives manage mini-grid electrification of grain milling and fish drying, the sustainability of the enterprises is boosted (Abt Global, 2023).

2.4.3 Renewable Technologies for ASM

Hybrid solar systems are increasingly used for ASM, including ore processing, ventilation, and mercury-free refining (UNEP, 2024). Tarkwa District in Ghana and Niger State in Nigeria have solar-powered crushers and concentrators, which have reduced diesel use by over 50% and boosted profit margins (planetGOLD Ghana, 2024). However, adoption remains slow due to gendered financial barriers and a lack of technical training (Hilson, 2024).

2.5 Gender-Responsive Finance and Investment Mechanisms

The integration of gender-responsive financing sounds promising, yet it remains uneven. For example, in Nigeria, the Bank of Industry launched the GLOW Women's Loan Facility (2025) where women entrepreneurs in renewable energy can assess up to ₦50 million loans with 7% interest while movable assets can be used as collateral (Bank of Industry, 2025). In Ghana, Development Bank Ghana (DBG) partnered with AFAWA and ENERGIA to provide blended finance to women accessing loans in renewable energy and agribusiness (DBG, 2024).

CGAP (2023) noted that some micro-finance entities and digital lenders are implementing asset-based financing for solar irrigation and dryers. However, northern rural regions of the country encounter significant coverage gaps. It has been documented that the blended financing gaps in the literature are closed through secure inclusive financing—concessional loans, and technical and after-sales service support (OECD, 2024).

2.6 Policy and Regional Frameworks

The ECOWAS Policy for Gender Mainstreaming in Energy Access (ECREEE, 2022), which focuses on the empowerment of women in clean-energy value chains, includes gender audits for national energy programs. Both Nigeria's Energy Transition Plan (Federal Government of Nigeria, 2022) and Integrated Energy Plan (2023) outline the program's integration on productive energy use for small enterprises. This is in sync with Ghana's National Energy Compact (Government of Ghana, 2025), which includes solar irrigation in rural development programs.

However, the absence of robust inter-ministerial collaboration, scarce funding at the subnational level, and lack of sex-disaggregated data remain obstacles. For policies to produce tangible gender impacts, the energy, environment, and women's affairs, and finance ministries must synergize (UN Women, 2024).

2.7 Lessons from Existing Evidence

1. **Bundled Solutions:** The integration of renewable technology, financing, and capacity building is a significant driver of adoption (GET.transform, 2023).
2. **Women's Cooperatives:** Enhanced repayment discipline and collective bargaining are achieved through cooperative ownership (ENERGIA, 2023).
3. **Value-Chain Integration:** The alignment of renewable initiatives with current agricultural and mining value chains promotes long-term sustainability (World Bank, 2023).
4. **Social Norm Engagement:** The involvement of traditional and religious leaders facilitates the acceptance of women's leadership (Arthur et al., 2022).
5. **Cross-Border Learning:** Innovation diffusion is strengthened through peer learning between women's associations in Ghana and Nigeria (ECREEE, 2022).

2.8 Literature Gaps

There have been important advancements in the areas of research discussed above. However, some major research gaps still exist:

- Few studies compare the economic returns of investing in renewable energy in women's agriculture and ASM enterprises in Ghana and Nigeria.
- Insufficient information on the gendered aspects of the financing of loans, specifically the repayment of loans in movable-asset lending systems.
- Little research has been done on the health and safety impacts of renewable energy and mercury-free mining on women.
- There has been very little longitudinal research on institutional incentives and enforcement of policies

concerning gendered aspects of energy integration.

2.9 Summary

There is consensus in the literature that women's agriculture and mining enterprises in the climate-affected areas of northern Ghana and Nigeria, specifically, have been important to the local economies and to economic resilience. Thus, it is disheartening that gendered inequalities in access to resources, technology, and finance are so deeply entrenched. With policy frameworks that are supportive, and finances that are gender responsive, implementing mercury-free processing along with solar irrigation and dryers will transform these value chains. It will promote climate resilience and gender equity.

3. Country Contexts

Table 1: Country Contexts

Category	Northern Ghana	Northern Nigeria
Climate Vulnerabilities	The five (5) Northern Regions of Ghana experience prolonged dry seasons, erratic rainfall, and flooding, which reduce crop yields and strain water resources. These conditions drive food insecurity, poverty, and hunger, undermining sustainable livelihoods and progress toward the SDGs.	In the two northern states where the study was carried out, Kwara experiences seasonal droughts and delayed rainfall, which affect cassava, maize, and rice production. Nasarawa experiences both drought and flooding, which disrupts agriculture and causes erosion in mining zones.
Women's Roles in Agriculture & Mining	Women lead smallholder farming, cultivating crops such as maize, groundnuts, millet, and vegetables. In artisanal and small-scale mining (ASM), they mainly handle ore washing, panning, and processing, often with limited access to mechanized tools.	In Kwara, women focus on crop production, processing, and marketing, with some involved in gold panning and quarry work. Deposits of lithium have been discovered but remain unmined. In Nasarawa, women play a stronger role in mining tin, columbite, and gemstones, in addition to farming. Across both states, women's earnings remain lower due to limited access to capital, technology, and markets.

Energy Access & Renewable Energy Landscape	Energy access varies across sectors. For example, the 2024 National Energy Statistical Bulletin notes that in Ghana, electricity consumption by the agricultural sector in 2023 was only 39GWh out of a total of 18,849GWh. Inequalities in energy access are not only sector-based but also differ between urban and rural areas, with rural areas relying heavily on biomass and kerosene. Solar home systems and small-scale solar irrigation are	Rural electrification remains low, pushing women to depend on petrol and diesel generators for processing and irrigation. Pilot solar technologies such as milling machines, dryers, and pumps show potential but high upfront costs, limited financing, and weak technical support constrain adoption. Expanding affordable, sustainable renewable energy solutions is both urgent and promising.
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	emerging but still not widespread. It is concerning that in 2023, solar power made up less than 1% of Ghana's total energy supply. As a policy response to address the limited use of solar energy, the Renewable Energy and Green Transition Fund has been introduced to, among other goals, provide solar-powered irrigation to improve agricultural productivity in climate-vulnerable regions like northern Ghana.	
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4. Key Findings

The research aimed to answer the research questions, and the key findings are presented below.

a. Socioeconomic and Gender Profiles

What are the socio-economic profiles of women involved in agriculture and mining in the study areas?

The research shows that women involved in agriculture and mining in Ghana and Nigeria face significant structural inequalities that limit their opportunities. With limited literacy skills, high dependency burdens, and seasonal incomes, they often rely on petty trade to survive during off-season periods. Limited access to formal financial services further hampers their ability to invest, making their livelihoods unstable and leaving them with few resources to build resilience or increase productivity.

Women's involvement in the mining industry includes minor jobs, such as hauling from the pit to the dump site and pre-treatment of the products. We also have a few women who own mining companies.
— State Chairman, Miners Association of Nigeria (MAN), Nasarawa State Chapter, Nigeria

b. Energy Needs and Gaps

What are their current sources and uses of energy, and what gaps remain in access, affordability, and reliability?

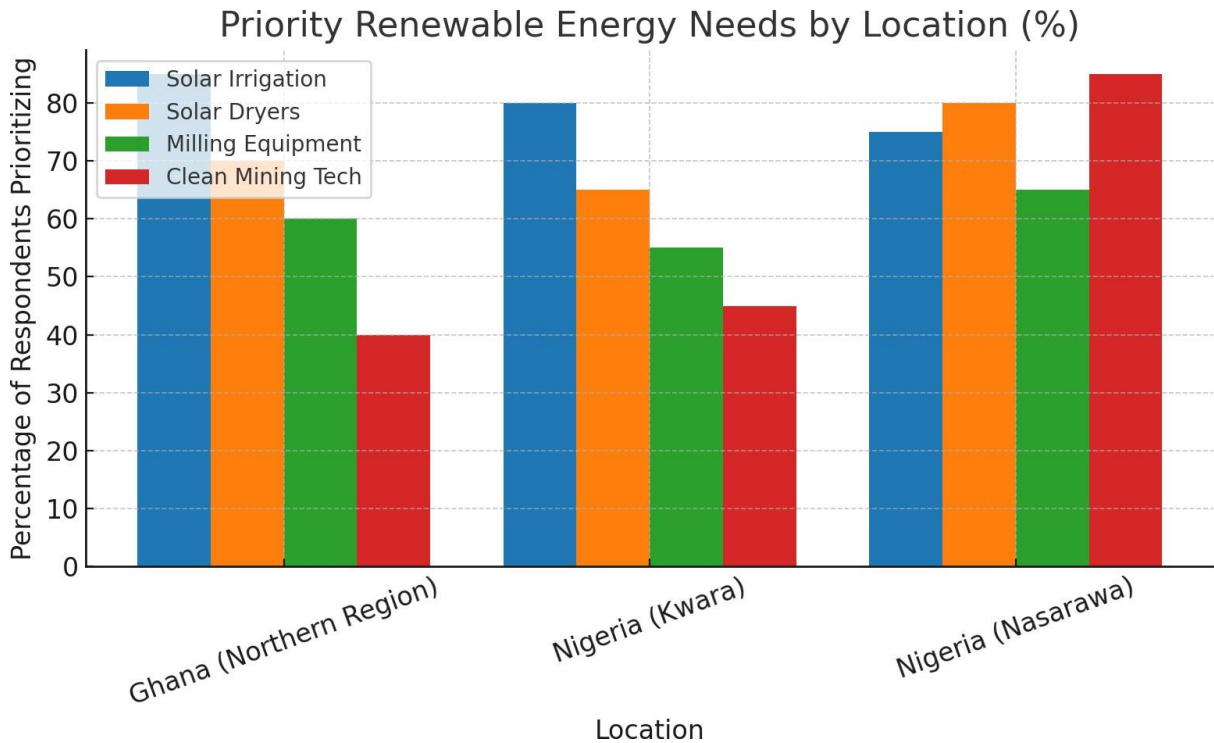
Energy access remains limited, expensive, and unsafe for women farmers and miners, reducing productivity and increasing health risks. In Ghana's Upper East Region and Kwara State, women

highlighted the need for solar irrigation pumps, while in Nasarawa State, miners pointed out the lack of clean ore-processing technologies. Without affordable and safe options, women are trapped in cycles of low productivity and vulnerability, emphasizing the urgent need for tailored renewable energy solutions.

“I am a smallholder woman farmer in Nigeria from Kwara State, and I have been farming for over 10 years. I mainly grow maize and use mostly traditional methods with limited access to machines or irrigation. I also process some of my farm produce for extra income, such as turning maize into pap and flour.”

— **Female Smallholder Farmer, Kwara State, Nigeria**

Chart 1: Priority Renewable Energy Needs by Location (%)



In Ghana’s Northern Region, solar irrigation emerges as the top priority with approximately 85 percent demand. Solar dryers, at about 70 percent, and milling equipment, at around 60 percent, are also considered important needs in the area.

In Kwara State, Nigeria, solar irrigation again ranks highest, with an estimated 80 percent demand. This is followed by solar dryers at 65 percent and milling equipment at 55 percent, showing a similar pattern to Ghana.

In contrast, **Nasarawa State in Nigeria** presents a more balanced set of priorities. Clean mining technology stands out with very high demand, at around 85 percent, alongside solar dryers at 80 percent. Solar irrigation also remains significant at 75 percent, with milling equipment following closely at 65 percent.

Overall, the key takeaway is that solar irrigation dominates as the primary renewable energy need in both Ghana and Kwara, while Nasarawa demonstrates more diversified needs, with clean mining technology emerging as the top demand.

c. Climate Impacts

How does climate change impact their livelihoods, and what adaptation strategies are they using?

Climate change has a significant impact on the livelihoods of women in agriculture and mining. Unpredictable rainfall shortens growing seasons and limits crop options, harming income and food security. Flooding in mining areas stops digging, damages equipment, and increases safety hazards, all of which make women more vulnerable and complicate adaptation efforts.

d. Renewable Energy Opportunities

What renewable energy solutions are feasible, acceptable, and scalable in these contexts?

Women farmers and miners are eager to adopt renewable energy solutions that can reduce workloads, increase productivity, and enhance safety. Solar-powered irrigation systems, dryers, cold storage facilities, milling equipment, and clean ore-processing technologies provide clear advantages. However, sustainability depends on affordability, training, and accessible maintenance, without which these innovations risk being underused.

e. Institutional and Policy Landscape

What policies, programs, and institutions currently support or hinder women's participation in renewable energy-driven value chains?

Nigeria's Renewable Energy Master Plan and National Gender Policy outline broad goals for expanding renewable energy and promoting gender inclusion, but they lack specific actions that address women's roles in agriculture and mining. Ghana's policy environment is more complex, including the Renewable Energy Act, Renewable Energy Master Plan, Nationally Determined Contribution (NDC) Policy Actions, and gender mainstreaming frameworks, along with the Renewable Energy and Green Transition Fund. However, in both countries, poor rural implementation and limited outreach mean many women remain unaware of or excluded from

these initiatives. The main issue is not the absence of policies but ensuring gender-responsive implementation and genuine inclusion of women’s voices so that strategies lead to real support.

5. Comparative Analysis

Table 2: Comparative Analysis across the Research Areas.

Category	Findings
Similarities	Women are mainly engaged in lower-value, labor-intensive tasks. Climate change directly reduces productivity in both agriculture and mining. Energy poverty remains a major barrier to livelihood diversification.
Differences	Mining is more prominent in Nasarawa than in Kwara, while Kwara has stronger agricultural and commercial value chains. Ghana's renewable energy frameworks are more advanced, though Nigeria has a greater diversity of pilot projects.
Regional Synergies	Both countries have potential for collaborative learning on solar irrigation adoption, strengthening women-led cooperatives, and scaling financing models for renewable energy enterprises.

6. Recommendations

a. For Policy Makers

Policy makers in Ghana and Nigeria should incorporate renewable energy solutions for women farmers and miners into national agricultural and mining strategies. Besides broad commitments, policies must include provisions that directly support grassroots women. Enhancing gender-responsive budgeting in climate and energy policies will ensure fair resource distribution, reduce access gaps, and hold governments accountable for measurable progress.

“PPPs are powerful tools for promoting gender equity when intentionally designed. They enable the government to institutionalize inclusion through concession agreements, performance indicators, and project governance structures.”

— Natural Resource Governance Expert, Ghana

b. For Energy and Development Actors

Energy and development partners have a key role in enabling access by creating tailored financing mechanisms such as pay-as-you-go or microcredit schemes that reduce upfront costs. Equally, technical training in equipment operation, maintenance, and business management is essential to empower women as confident users and service providers. Combining financial flexibility with skills development will make renewable energy adoption more sustainable and transformative.

c. For Communities and Civil Society

At the community level, women-led cooperatives should be supported to pool resources and enhance bargaining power in renewable energy markets. In addition, awareness campaigns are necessary to emphasize the economic and health benefits of clean energy, shift perspectives, and increase demand. Civil society can connect policy and practice by mobilizing women, creating accountability, and ensuring solutions are community-owned and sustainable.

d. For Cross-Border Collaboration

Given the shared challenges in Ghana and Nigeria, strengthening cross-border collaboration within ECOWAS is essential. Regional platforms where women can share experiences on renewable energy adoption would speed up learning and innovation. Coordinated programs that test similar solutions in both countries would produce evidence for expansion, minimize duplication, and boost regional bargaining power to attract investment and expertise.

7. Implications

These findings highlight clear implications for multiple stakeholders. For governments, renewable energy and gender policies must move from aspiration to action through concrete, gender-responsive measures and aligned budgets. Without targeted investments, women's participation in renewable energy value chains will remain minimal.

For energy and development actors, the implication is that financial and technical barriers must be addressed simultaneously. Flexible financing models and capacity-building programs will not only enable adoption but also position women as renewable energy entrepreneurs and innovators.

For communities and civil society, the emphasis must be on collective action through cooperatives and awareness initiatives. Rooting interventions in community ownership increases sustainability while amplifying the social and economic benefits of renewable energy.

At the regional level, Ghana and Nigeria's shared challenges highlight the importance of ECOWAS-driven collaboration. Knowledge-sharing platforms and coordinated programs would accelerate adoption, enhance investment opportunities, and build regional capacity for sustainable

energy transitions.

Taken together, these implications show that advancing gender-responsive renewable energy requires coordinated efforts across policy, finance, technology, community engagement, and regional cooperation, ensuring women are central to climate adaptation and sustainable growth.

8. Conclusion

Investing in renewable energy solutions for women's agricultural and mining enterprises in Northern Ghana and Nigeria, especially in Kwara and Nasarawa States, offers a significant multi-sectoral opportunity. By addressing energy poverty, we enhance productivity, strengthen climate resilience, and promote gender equality. Coordinated efforts between policymakers, private sector stakeholders, and civil society will be vital in creating an inclusive, sustainable future for these communities affected by climate change.

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